**MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY**

WATER RESOURCES DIVISION
NONPOINT SOURCE PROGRAM

STORM WATER RUNOFF CALCULATOR INSTRUCTIONS

# Contents

# Acronyms

AOI – Area of Interest

BMP – Best Management Practice

EGLE – Michigan Department of Environment, Great Lakes, and Energy

NOAA – National Oceanic and Atmospheric Administration

NPS – Nonpoint Source

USDA - United States Department of Agriculture

WRD – Water Resources Division

WSS – Web Soil Survey

# 1.0 INSTRUCTIONS

**Using the NPS Storm Water Calculator**

1. At the top of the spreadsheet, enter the site name and the total drainage area of the site in acres.
2. Enter the design rainfall event in inches in the space provided. Follow the guidance on the Rainfall tab or in Section 2.0 of the "NPS Storm Water Calculator Manual" for determining local rainfall amounts (often the 2-yr 24-hr storm). It is important to note that this is the total amount of rainfall and not runoff for the site.
3. In the presettlement table, enter the area of each applicable land cover and soil combination for the presettlement condition in acres. The total area must add up to the total drainage area recorded at the top of the spreadsheet. Note here the runoff volume for each land use cover and soil type must be calculated separately and then summed for the entire site. No composite CN can be used. Consult with NPS technical staff if a land cover at the site is not represented to determine an appropriate CN. For guidance on identifying presettlement land cover and soils, please see the "Presettlement Land Cover" and "Soils" tabs of the spreadsheet or Sections 3.0 and 4.0 of the "NPS Storm Water Calculator Manual", respectively.
4. In the post-development table enter the proposed cover type and soil type and the amount of impervious area. The total area at the bottom of the table must match the total drainage area recorded at the top of the spreadsheet. Similarly, the total area for each soil group should be equal to or less (depending on the amount of impervious surface added) to the values reported in the presettlement table, unless new soils are being brought to the site. Cover and soil type can be copied from the presettlement table and pasted to the post-development table if applicable. A CN for each new cover type must be selected but composite CNs should not be used. Consult with NPS technical staff if a land cover at the site is not represented to determine an appropriate CN.
5. The spreadsheet automatically calculates the Runoff Volume Increase in cubic feet, and it's shown in the blue cell near the bottom of the spreadsheet. This is the volume of Storm Water runoff that must be controlled.
6. For additional guidance on how to use this spreadsheet please see the "Example Scenario" tab or Section 5.0 of the "NPS Storm Water Calculator Manual" for a filled-out example of how to use this spreadsheet.

Note: If the goal for the site is to treat the Water Quality Volume generated by 1 inch of runoff over the entire site the cell on the lower right of the spreadsheet performs that calculation based on the value provided for the "Total Drainage Area" at the top of the spreadsheet.

# 2.0 RAINFALL

## Obtaining Rainfall Data from NOAA ATLAS 14

Go to the [NOAA ATLAS 14 Website](#)

The image below shows the load page, follow the instructions on the website to select the site location, this can be done by entering latitude/longitude, address, or on the interactive map.

After selecting your site location scroll down the web page below the map to the POINT PRECIPITATION FREQUENCY (PF) ESTIMATES and select the "PF tabular" option. It should look like the image below:

## POINT PRECIPITATION FREQUENCY (PF) ESTIMATES
### WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
### NOAA Atlas 14, Volume 8, Version 2

PF tabular | PF graphical | Supplementary information | Print page

### PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

| Duration | \multicolumn{10}{c}{Average recurrence interval (years)} | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.296 (0.233-0.381) | 0.346 (0.272-0.445) | 0.431 (0.339-0.556) | 0.506 (0.396-0.654) | 0.616 (0.468-0.819) | 0.705 (0.524-0.943) | 0.799 (0.574-1.08) | 0.898 (0.620-1.24) | 1.04 (0.688-1.45) | 1.15 (0.740-1.61) |
| 10-min | 0.433 (0.342-0.557) | 0.506 (0.399-0.651) | 0.631 (0.496-0.814) | 0.741 (0.579-0.958) | 0.902 (0.686-1.20) | 1.03 (0.767-1.38) | 1.17 (0.840-1.59) | 1.32 (0.908-1.81) | 1.52 (1.01-2.12) | 1.68 (1.08-2.36) |
| 15-min | 0.528 (0.417-0.680) | 0.617 (0.486-0.794) | 0.770 (0.605-0.993) | 0.904 (0.706-1.17) | 1.10 (0.837-1.46) | 1.26 (0.935-1.68) | 1.43 (1.02-1.94) | 1.60 (1.11-2.21) | 1.85 (1.23-2.59) | 2.05 (1.32-2.88) |
| 30-min | 0.755 (0.596-0.972) | 0.881 (0.694-1.13) | 1.10 (0.863-1.42) | 1.29 (1.01-1.67) | 1.57 (1.20-2.09) | 1.80 (1.34-2.41) | 2.05 (1.47-2.78) | 2.31 (1.59-3.18) | 2.67 (1.77-3.74) | 2.96 (1.91-4.16) |
| 60-min | 0.953 (0.752-1.23) | 1.13 (0.893-1.46) | 1.44 (1.13-1.86) | 1.71 (1.34-2.22) | 2.11 (1.61-2.81) | 2.43 (1.81-3.26) | 2.77 (1.99-3.76) | 3.13 (2.16-4.32) | 3.63 (2.41-5.09) | 4.03 (2.60-5.67) |
| 2-hr | 1.15 (0.920-1.46) | 1.39 (1.11-1.76) | 1.79 (1.42-2.27) | 2.14 (1.69-2.72) | 2.65 (2.04-3.48) | 3.06 (2.30-4.04) | 3.50 (2.55-4.68) | 3.96 (2.77-5.38) | 4.59 (3.10-6.36) | 5.10 (3.34-7.09) |
| 3-hr | 1.26 (1.01-1.59) | 1.53 (1.23-1.92) | 1.99 (1.59-2.51) | 2.39 (1.91-3.02) | 2.98 (2.31-3.88) | 3.46 (2.62-4.52) | 3.95 (2.90-5.26) | 4.48 (3.16-6.06) | 5.21 (3.54-7.16) | 5.79 (3.83-8.00) |
| 6-hr | 1.51 (1.23-1.87) | 1.80 (1.46-2.23) | 2.30 (1.87-2.86) | 2.76 (2.22-3.43) | 3.43 (2.70-4.41) | 3.98 (3.06-5.15) | 4.57 (3.40-6.01) | 5.20 (3.73-6.95) | 6.08 (4.20-8.27) | 6.79 (4.56-9.27) |
| 12-hr | 1.84 (1.52-2.25) | 2.10 (1.73-2.56) | 2.58 (2.12-3.15) | 3.02 (2.47-3.71) | 3.71 (2.98-4.73) | 4.30 (3.37-5.51) | 4.94 (3.74-6.43) | 5.64 (4.11-7.47) | 6.65 (4.67-8.95) | 7.48 (5.10-10.1) |
| 24-hr | 2.17 (1.82-2.62) | 2.44 (2.04-2.94) | 2.95 (2.45-3.55) | 3.42 (2.83-4.13) | 4.15 (3.38-5.21) | 4.78 (3.79-6.03) | 5.46 (4.20-7.01) | 6.21 (4.60-8.11) | 7.30 (5.20-9.70) | 8.18 (5.67-10.9) |
| 2-day | 2.48 (2.10-2.93) | 2.84 (2.40-3.36) | 3.48 (2.93-4.12) | 4.05 (3.40-4.82) | 4.89 (4.02-6.02) | 5.60 (4.49-6.94) | 6.35 (4.93-8.00) | 7.15 (5.35-9.17) | 8.27 (5.98-10.8) | 9.18 (6.45-12.1) |
| 3-day | 2.73 (2.33-3.20) | 3.10 (2.65-3.64) | 3.77 (3.20-4.43) | 4.37 (3.69-5.15) | 5.25 (4.34-6.40) | 5.98 (4.84-7.35) | 6.76 (5.30-8.45) | 7.60 (5.74-9.68) | 8.78 (6.40-11.4) | 9.72 (6.90-12.7) |
| 4-day | 2.94 (2.52-3.43) | 3.32 (2.85-3.87) | 3.99 (3.41-4.66) | 4.60 (3.91-5.39) | 5.50 (4.58-6.67) | 6.25 (5.09-7.63) | 7.06 (5.57-8.76) | 7.92 (6.02-10.0) | 9.14 (6.71-11.8) | 10.1 (7.23-13.1) |
| 7-day | 3.46 (3.00-3.98) | 3.87 (3.35-4.45) | 4.58 (3.96-5.28) | 5.22 (4.49-6.04) | 6.18 (5.20-7.39) | 6.98 (5.74-8.41) | 7.83 (6.25-9.61) | 8.75 (6.73-11.0) | 10.0 (7.46-12.8) | 11.1 (8.02-14.2) |
| 10-day | 3.92 (3.42-4.47) | 4.36 (3.80-4.97) | 5.12 (4.46-5.86) | 5.81 (5.03-6.66) | 6.82 (5.77-8.07) | 7.65 (6.34-9.14) | 8.54 (6.86-10.4) | 9.48 (7.35-11.8) | 10.8 (8.10-13.7) | 11.9 (8.66-15.2) |
| 20-day | 5.28 (4.68-5.93) | 5.83 (5.16-6.55) | 6.76 (5.96-7.61) | 7.56 (6.63-8.53) | 8.70 (7.44-10.1) | 9.61 (8.05-11.3) | 10.5 (8.59-12.6) | 11.5 (9.06-14.1) | 12.9 (9.78-16.0) | 13.9 (10.3-17.5) |
| 30-day | 6.49 (5.79-7.21) | 7.14 (6.38-7.94) | 8.21 (7.30-9.15) | 9.10 (8.05-10.2) | 10.3 (8.90-11.8) | 11.3 (9.53-13.1) | 12.3 (10.1-14.5) | 13.2 (10.5-16.0) | 14.6 (11.1-17.9) | 15.5 (11.6-19.4) |
| 45-day | 8.08 (7.27-8.89) | 8.87 (7.97-9.77) | 10.1 (9.07-11.2) | 11.1 (9.94-12.3) | 12.5 (10.8-14.1) | 13.5 (11.5-15.4) | 14.5 (12.0-16.9) | 15.4 (12.3-18.4) | 16.7 (12.9-20.3) | 17.6 (13.3-21.8) |
| 60-day | 9.48 (8.58-10.4) | 10.4 (9.39-11.4) | 11.8 (10.7-13.0) | 12.9 (11.6-14.2) | 14.4 (12.5-16.1) | 15.4 (13.2-17.5) | 16.4 (13.6-19.0) | 17.3 (13.9-20.5) | 18.5 (14.3-22.3) | 19.2 (14.7-23.7) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates ▼ | Submit

From the PF Estimates table, identify the recurrence (column) and duration (row) of the design storm (e.g. 2-yr 24-hr) and find where they meet. This is the rainfall generated by the design storm and should be used on in the "Runoff Volume" tab as the "Design Rainfall Event".

## POINT PRECIPITATION FREQUENCY (PF) ESTIMATES
### WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
### NOAA Atlas 14, Volume 8, Version 2

| PF tabular | PF graphical | Supplementary information | | Print page |
|---|---|---|---|---|

**PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | \multicolumn{10}{c}{Average recurrence interval (years)} | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.296 (0.233-0.381) | 0.346 (0.272-0.445) | 0.431 (0.339-0.556) | 0.506 (0.396-0.654) | 0.616 (0.468-0.819) | 0.705 (0.524-0.943) | 0.799 (0.574-1.08) | 0.898 (0.620-1.24) | 1.04 (0.688-1.45) | 1.15 (0.740-1.61) |
| 10-min | 0.433 (0.342-0.557) | 0.506 (0.399-0.651) | 0.631 (0.496-0.814) | 0.741 (0.579-0.958) | 0.902 (0.686-1.20) | 1.03 (0.767-1.38) | 1.17 (0.840-1.59) | 1.32 (0.908-1.81) | 1.52 (1.01-2.12) | 1.68 (1.08-2.36) |
| 15-min | 0.528 (0.417-0.680) | 0.617 (0.486-0.794) | 0.770 (0.605-0.993) | 0.904 (0.706-1.17) | 1.10 (0.837-1.46) | 1.26 (0.935-1.68) | 1.43 (1.02-1.94) | 1.60 (1.11-2.21) | 1.85 (1.23-2.59) | 2.05 (1.32-2.88) |
| 30-min | 0.755 (0.596-0.972) | 0.881 (0.694-1.13) | 1.10 (0.863-1.42) | 1.29 (1.01-1.67) | 1.57 (1.20-2.09) | 1.80 (1.34-2.41) | 2.05 (1.47-2.78) | 2.31 (1.59-3.18) | 2.67 (1.77-3.74) | 2.96 (1.91-4.16) |
| 60-min | 0.953 (0.752-1.23) | 1.13 (0.893-1.46) | 1.44 (1.13-1.86) | 1.71 (1.34-2.22) | 2.11 (1.61-2.81) | 2.43 (1.81-3.26) | 2.77 (1.99-3.76) | 3.13 (2.16-4.32) | 3.63 (2.41-5.09) | 4.03 (2.60-5.67) |
| 2-hr | 1.15 (0.920-1.46) | 1.39 (1.11-1.76) | 1.79 (1.42-2.27) | 2.14 (1.69-2.72) | 2.65 (2.04-3.48) | 3.06 (2.30-4.04) | 3.50 (2.55-4.68) | 3.96 (2.77-5.38) | 4.59 (3.10-6.36) | 5.10 (3.34-7.09) |
| 3-hr | 1.26 (1.01-1.59) | 1.53 (1.23-1.92) | 1.99 (1.59-2.51) | 2.39 (1.91-3.02) | 2.98 (2.31-3.88) | 3.46 (2.62-4.52) | 3.95 (2.90-5.26) | 4.48 (3.16-6.06) | 5.21 (3.54-7.16) | 5.79 (3.83-8.00) |
| 6-hr | 1.51 (1.23-1.87) | 1.80 (1.46-2.23) | 2.30 (1.87-2.86) | 2.76 (2.22-3.43) | 3.43 (2.70-4.41) | 3.98 (3.06-5.15) | 4.57 (3.40-6.01) | 5.20 (3.73-6.95) | 6.08 (4.20-8.27) | 6.79 (4.56-9.27) |
| 12-hr | 1.84 (1.52-2.25) | 2.10 (1.73-2.56) | 2.58 (2.12-3.15) | 3.02 (2.47-3.71) | 3.71 (2.98-4.73) | 4.30 (3.37-5.51) | 4.94 (3.74-6.43) | 5.64 (4.11-7.47) | 6.65 (4.67-8.95) | 7.48 (5.10-10.1) |
| 24-hr | 2.17 (1.82-2.62) | 2.44 (2.04-2.94) | 2.95 (2.45-3.55) | 3.42 (2.83-4.13) | 4.15 (3.38-5.21) | 4.78 (3.79-6.03) | 5.46 (4.20-7.01) | 6.21 (4.60-8.11) | 7.30 (5.20-9.70) | 8.18 (5.67-10.9) |
| 2-day | 2.48 (2.10-2.93) | 2.84 (2.40-3.36) | 3.48 (2.93-4.12) | 4.05 (3.40-4.82) | 4.89 (4.02-6.02) | 5.60 (4.49-6.94) | 6.35 (4.93-8.00) | 7.15 (5.35-9.17) | 8.27 (5.98-10.8) | 9.18 (6.45-12.1) |
| 3-day | 2.73 (2.33-3.20) | 3.10 (2.65-3.64) | 3.77 (3.20-4.43) | 4.37 (3.69-5.15) | 5.25 (4.34-6.40) | 5.98 (4.84-7.35) | 6.76 (5.30-8.45) | 7.60 (5.74-9.68) | 8.78 (6.40-11.4) | 9.72 (6.90-12.7) |
| 4-day | 2.94 (2.52-3.43) | 3.32 (2.85-3.87) | 3.99 (3.41-4.66) | 4.60 (3.91-5.39) | 5.50 (4.58-6.67) | 6.25 (5.09-7.63) | 7.06 (5.57-8.76) | 7.92 (6.02-10.0) | 9.14 (6.71-11.8) | 10.1 (7.23-13.1) |
| 7-day | 3.46 (3.00-3.98) | 3.87 (3.35-4.45) | 4.58 (3.96-5.28) | 5.22 (4.49-6.04) | 6.18 (5.20-7.39) | 6.98 (5.74-8.41) | 7.83 (6.25-9.61) | 8.75 (6.73-11.0) | 10.0 (7.46-12.8) | 11.1 (8.02-14.2) |
| 10-day | 3.92 (3.42-4.47) | 4.36 (3.80-4.97) | 5.12 (4.46-5.86) | 5.81 (5.03-6.66) | 6.82 (5.77-8.07) | 7.65 (6.34-9.14) | 8.54 (6.86-10.4) | 9.48 (7.35-11.8) | 10.8 (8.10-13.7) | 11.9 (8.66-15.2) |
| 20-day | 5.28 (4.68-5.93) | 5.83 (5.16-6.55) | 6.76 (5.96-7.61) | 7.56 (6.63-8.53) | 8.70 (7.44-10.1) | 9.61 (8.05-11.3) | 10.5 (8.59-12.6) | 11.5 (9.06-14.1) | 12.9 (9.78-16.0) | 13.9 (10.3-17.5) |
| 30-day | 6.49 (5.79-7.21) | 7.14 (6.36-7.94) | 8.21 (7.30-9.15) | 9.10 (8.05-10.2) | 10.3 (8.90-11.8) | 11.3 (9.53-13.1) | 12.3 (10.1-14.5) | 13.2 (10.5-16.0) | 14.6 (11.1-17.9) | 15.5 (11.6-19.4) |
| 45-day | 8.08 (7.27-8.89) | 8.87 (7.97-9.77) | 10.1 (9.07-11.2) | 11.1 (9.94-12.3) | 12.5 (10.8-14.1) | 13.5 (11.5-15.4) | 14.5 (12.0-16.9) | 15.4 (12.3-18.4) | 16.7 (12.9-20.3) | 17.6 (13.3-21.8) |
| 60-day | 9.48 (8.58-10.4) | 10.4 (9.39-11.4) | 11.8 (10.7-13.0) | 12.9 (11.6-14.2) | 14.4 (12.5-16.1) | 15.4 (13.2-17.5) | 16.4 (13.6-19.0) | 17.3 (13.9-20.5) | 18.5 (14.3-22.3) | 19.2 (14.7-23.7) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: [Precipitation frequency estimates ▾] [Submit]

# 3.0 PRESETTLEMENT LAND COVER

**Obtaining presettlement land use data from the EGLE Wetlands Map Viewer**

There are a number of ways to collect presettlement land use data for sites. The following steps highlight one possible approach using the EGLE Wetland Map Viewer.
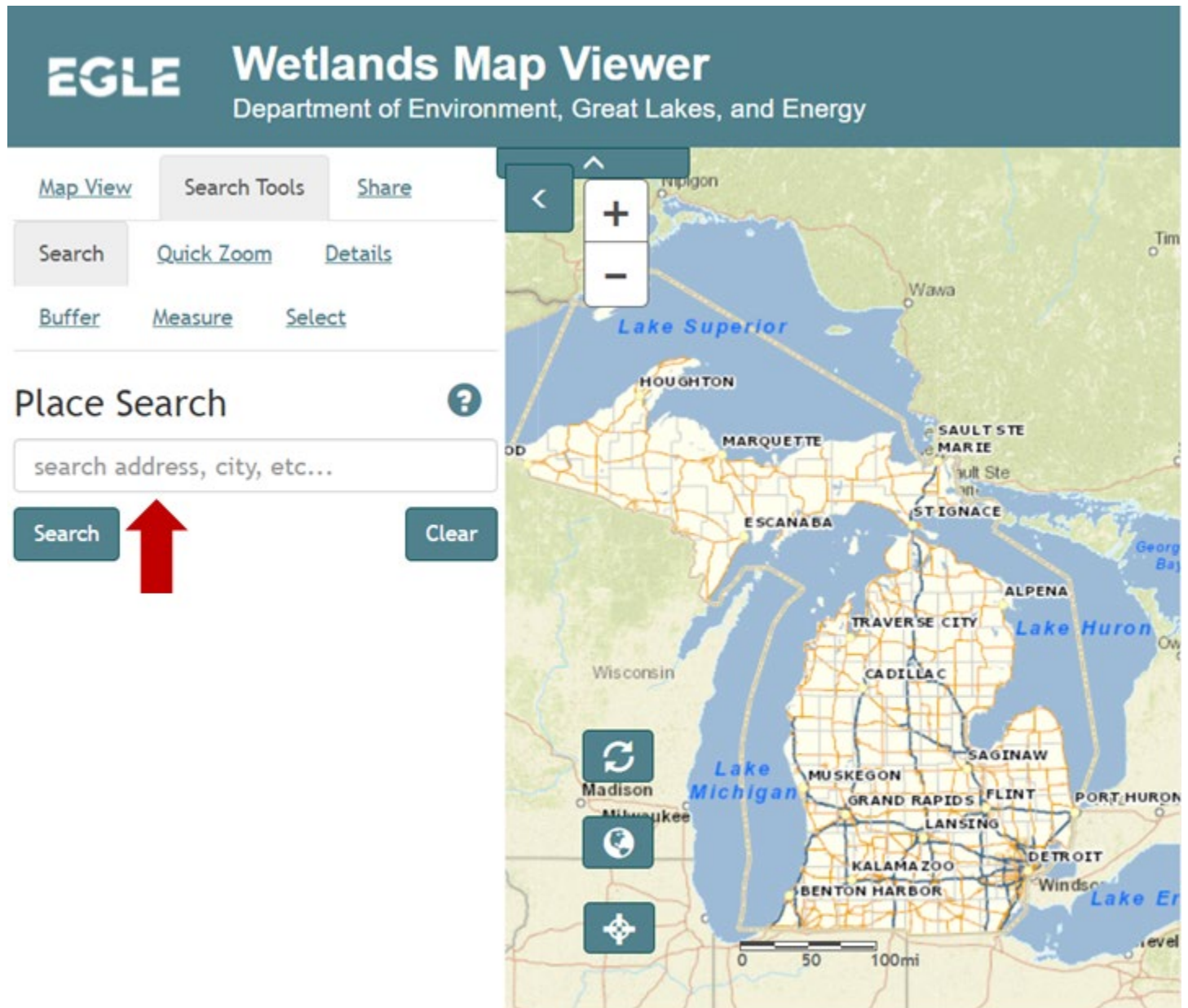
Go to the EGLE Wetland Map Viewer.

The image below shows the load page.
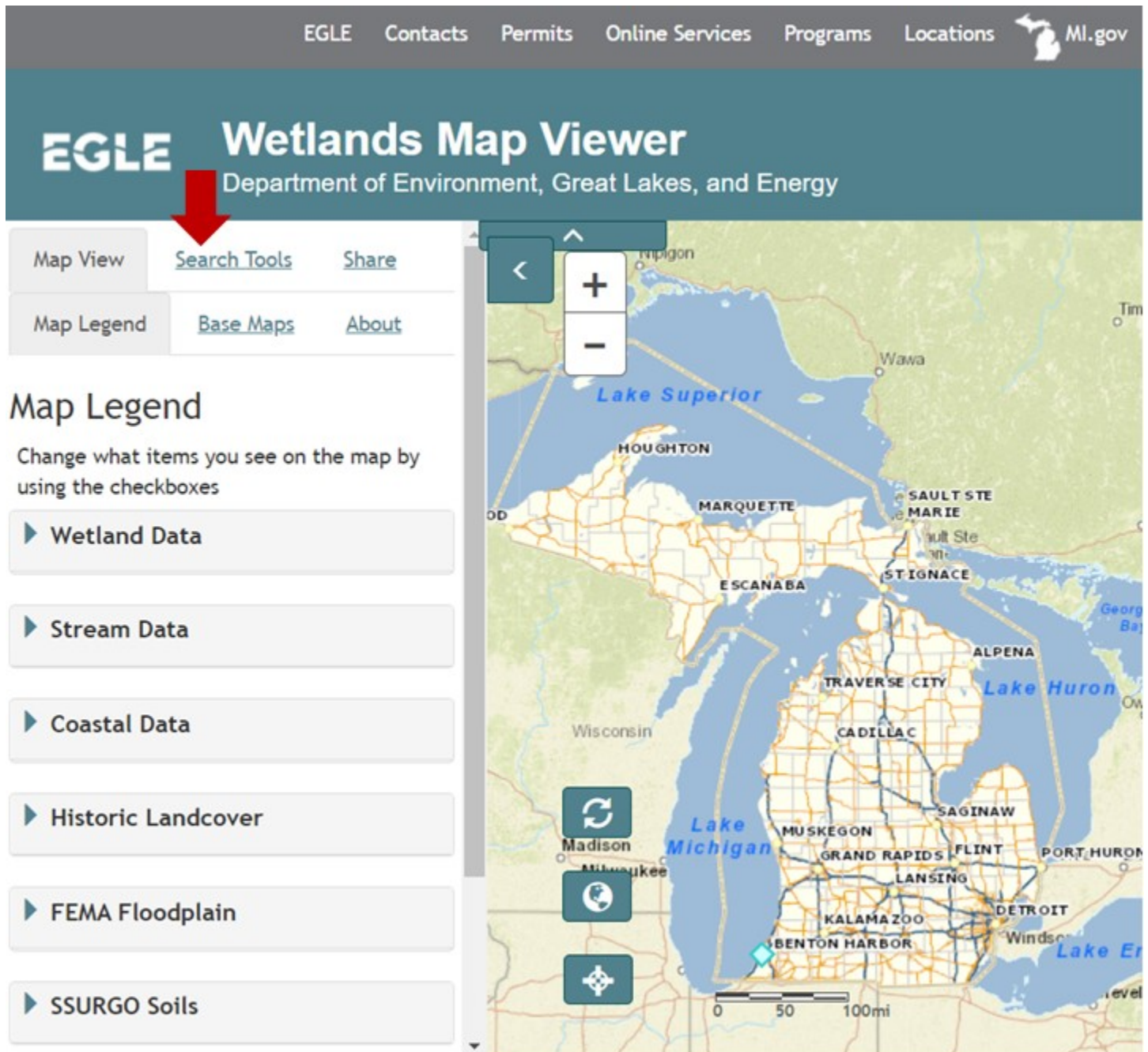
To locate a given site click on the "Search Tools" tab and use the search bar to find the design site (second image).

After locating the site, return to the "Map View" tab and on the left-hand panel, under "Map Legend" turnoff the "Part 303 Final Wetlands Inventory" layer under the "Wetland Data" drop down menu.
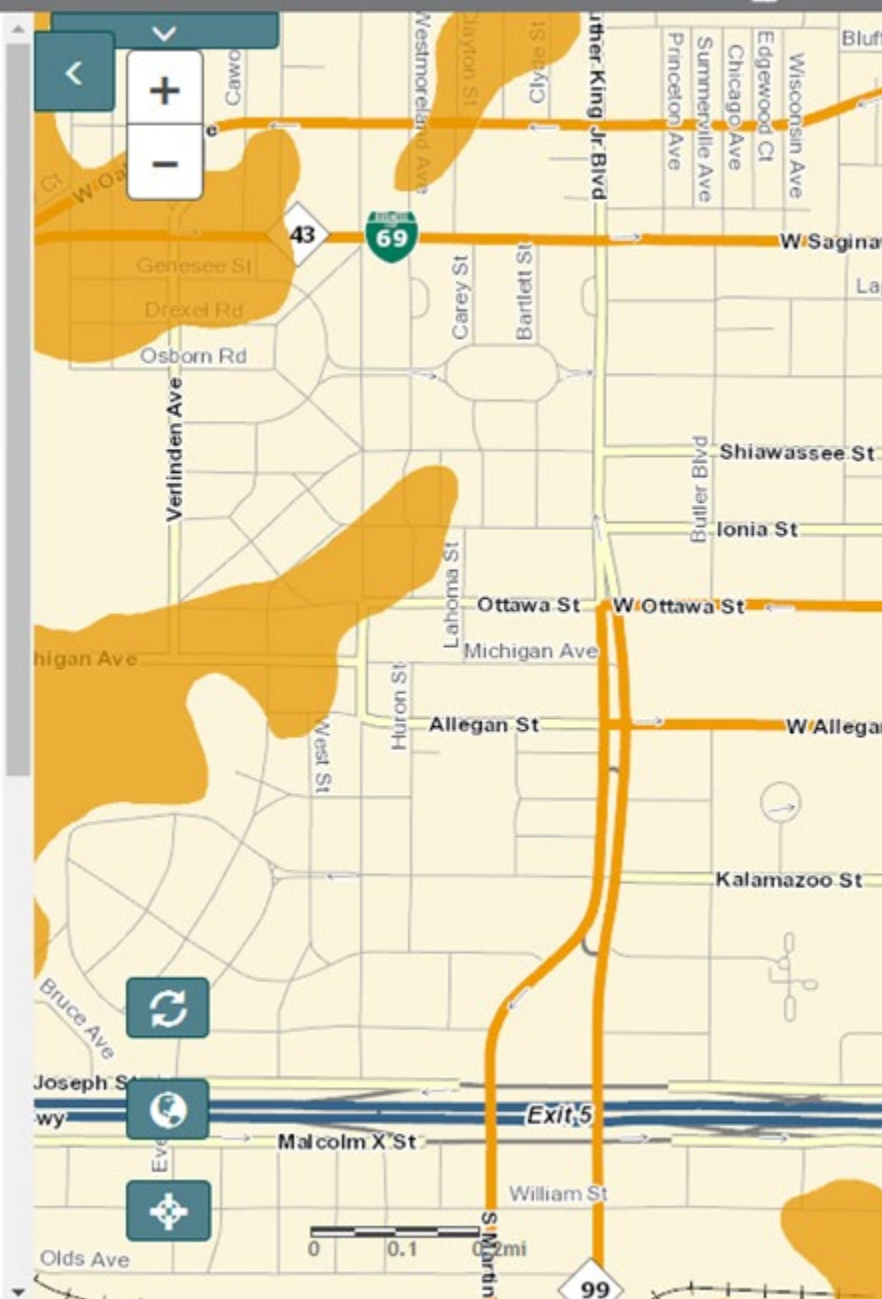
At this point you can add the site drainage area to the map. This can be done by going back to the "Search Tools" tab and then choosing "Select". If you know your drainage area you can use the "Freehand Polygon" under the "Draw" option to sketch in the drainage area.
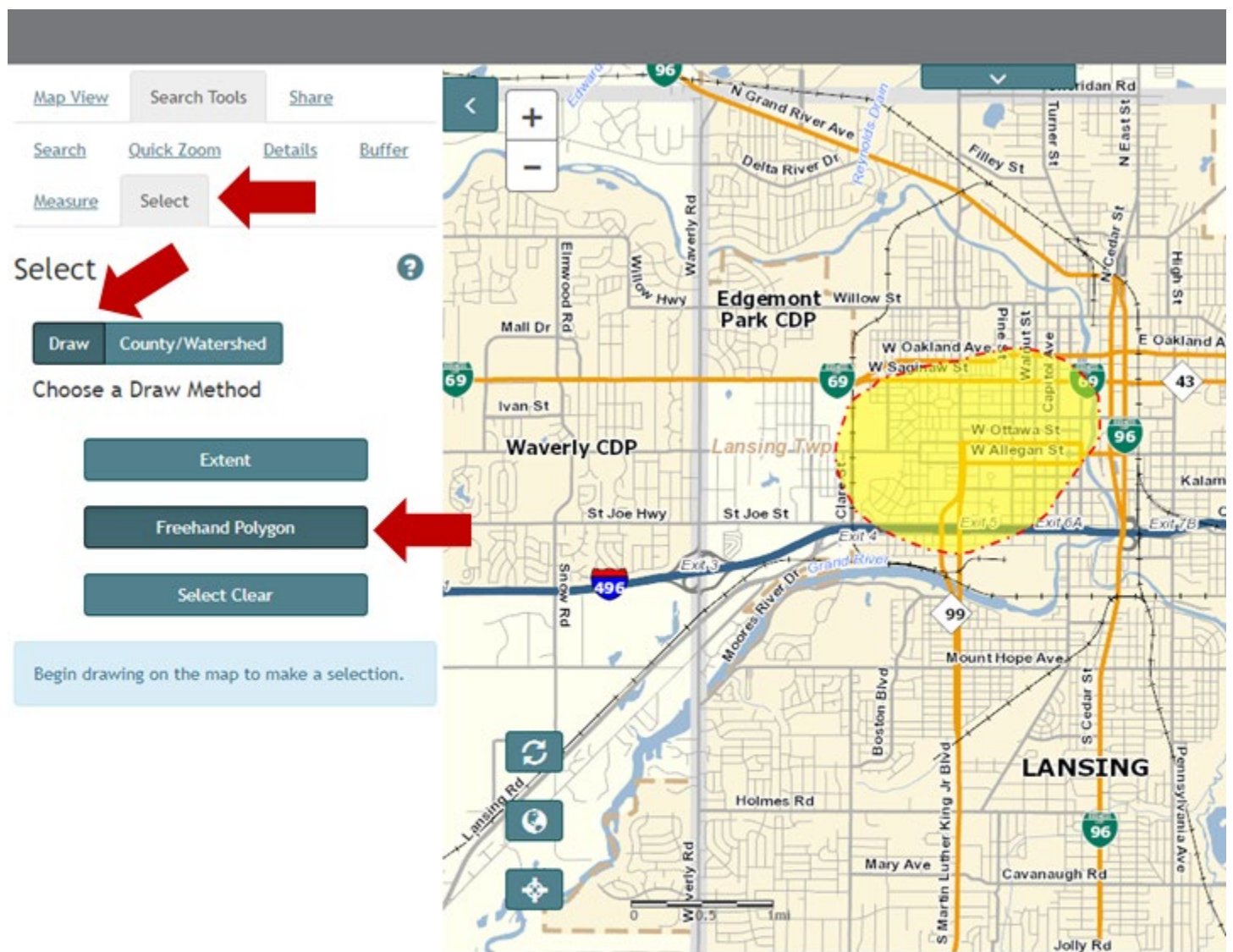
After adding the drainage area, return to the "Map View" tab and turn on the "MNFI Landcover Circa 1800" layer under the "Historic Landcover" drop down menu.
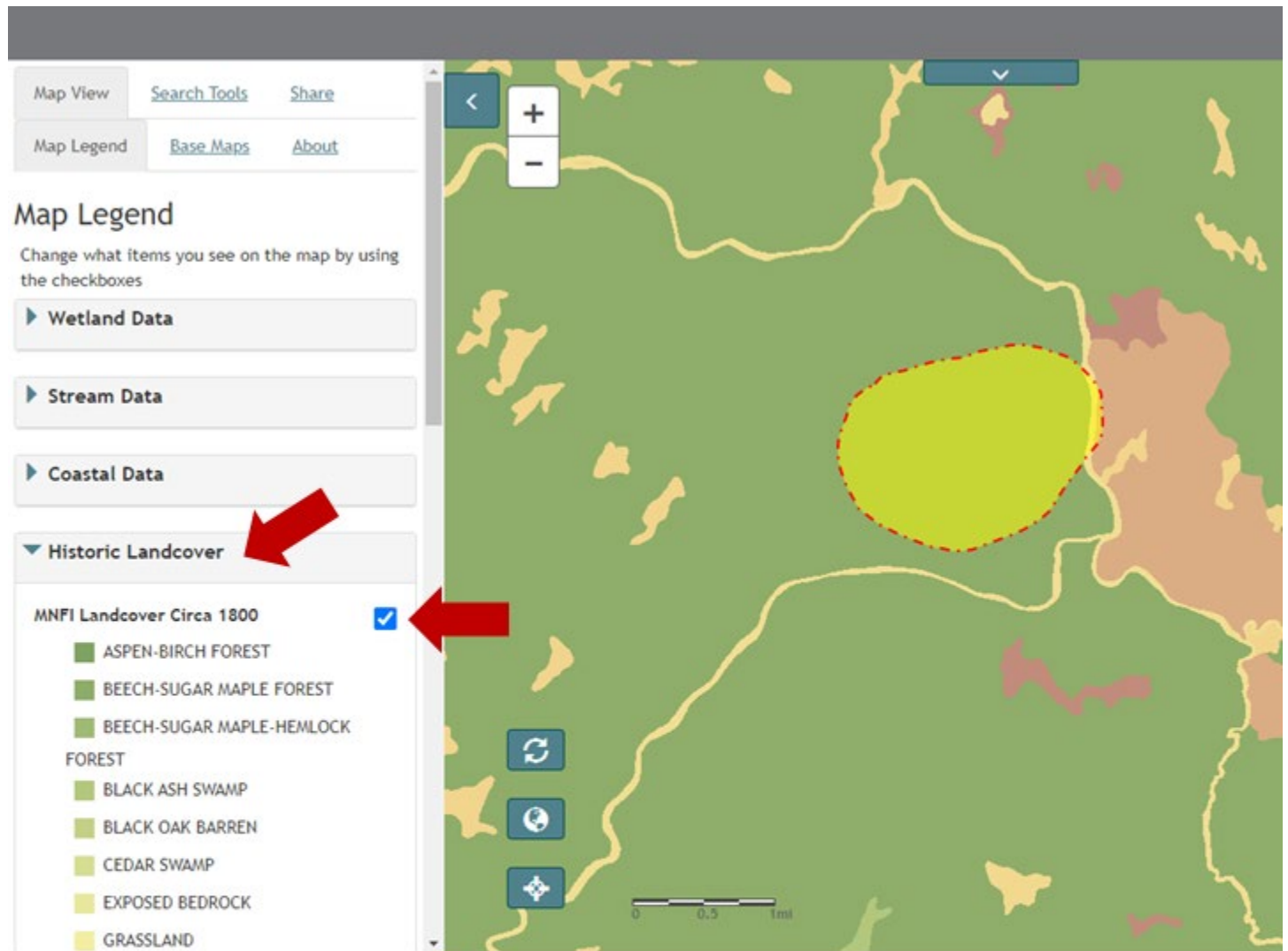
Once the landcover layer loads, clicking on the map will open the map details in the left-hand panel. Scroll down to the "Map Information" section to find the Historic Landcover for that point.



This can be repeated for each land use within the drainage area. It is important to note that presettlement runoff on the "Runoff Volume" tab is calculated based on both presettlement land use and soil type. Therefore, the map of presettlement land uses should be compared to a soil properties map to determine the acres of land for each row in the presettlement table on the "Runoff Volume" tab. In most case one or two land uses will make up a region.

# 4.0 SITE SOIL DATA

**Obtaining Soil Data from the USDA Web Soil Survey**

Go to the USDA Web Soil Survey Site.

Launch the site by clicking on the "START WSS" button at the top of the page.

Once launched the Web Soil Survey will open on the Area of Interest Tab. Here site locations can either be uploaded or searched using a number of options.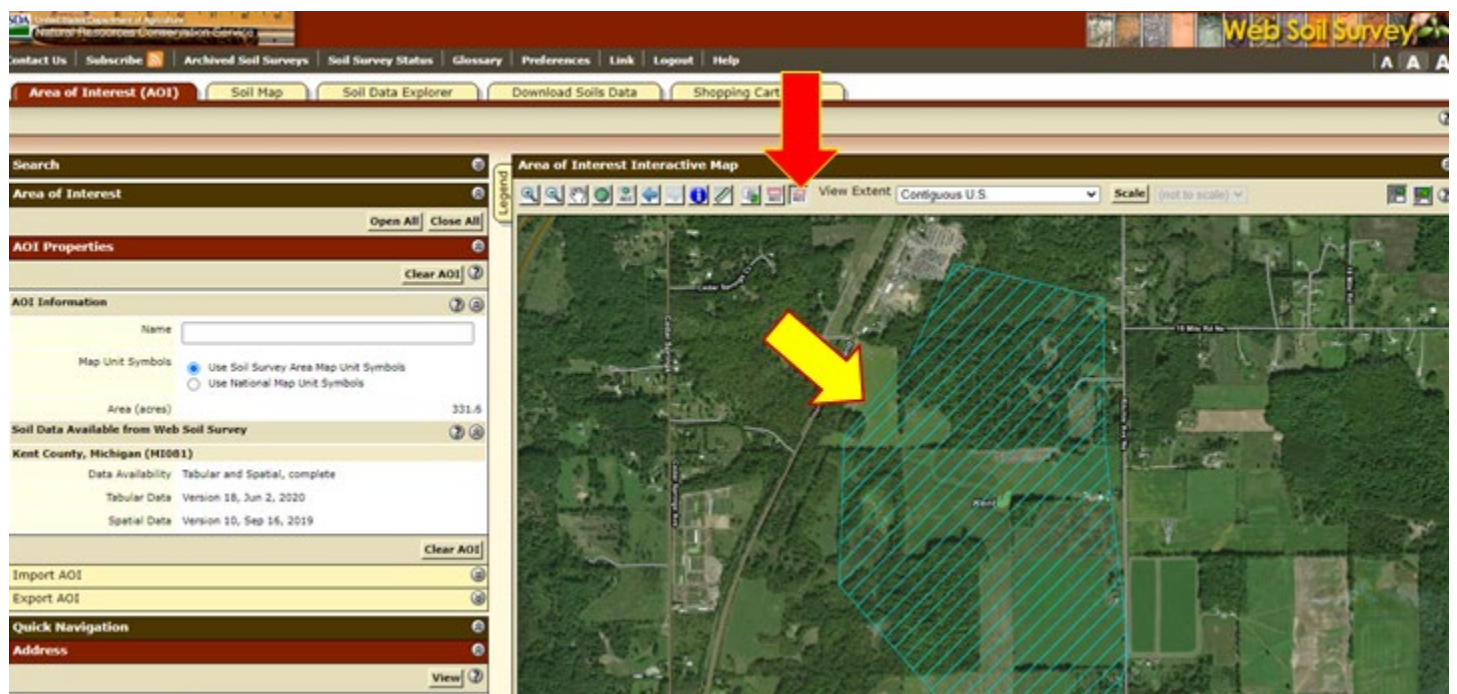 Clicking on the drop-down arrows next to any of the search options expand that search option and allow you to enter information regarding the site.
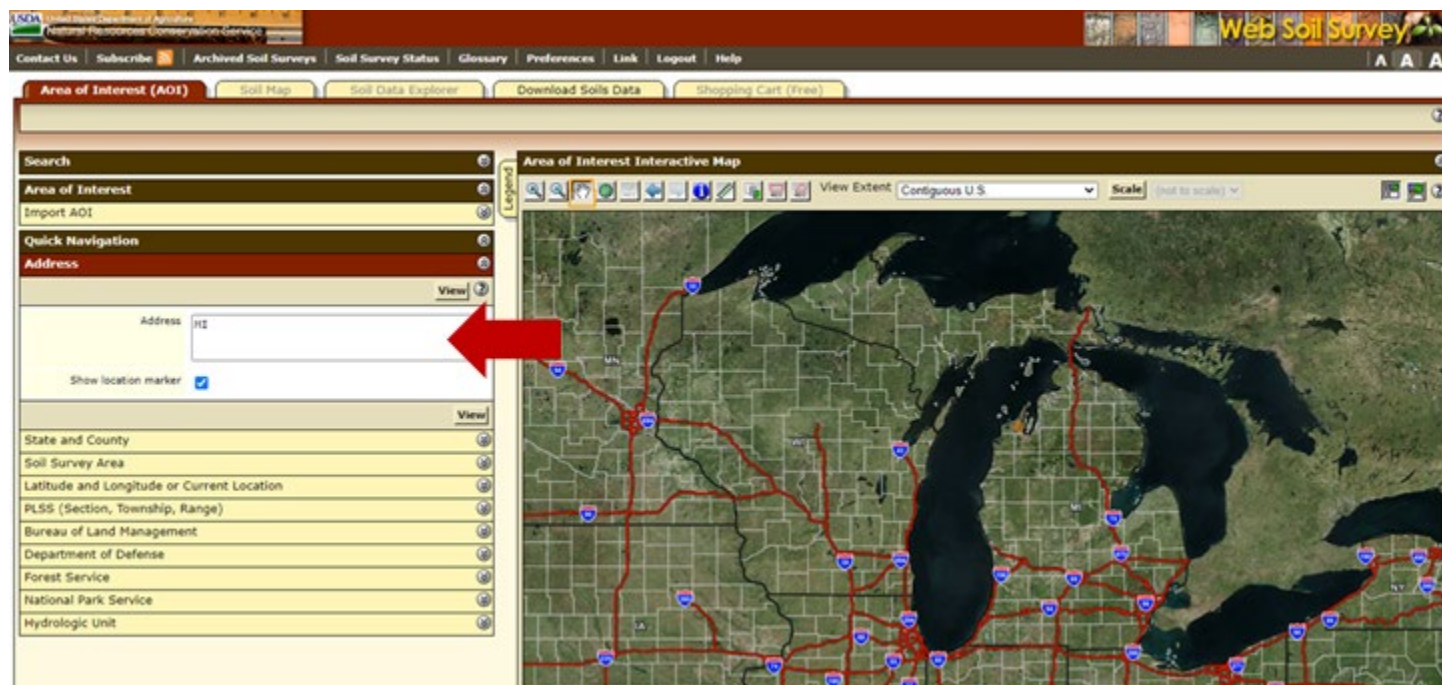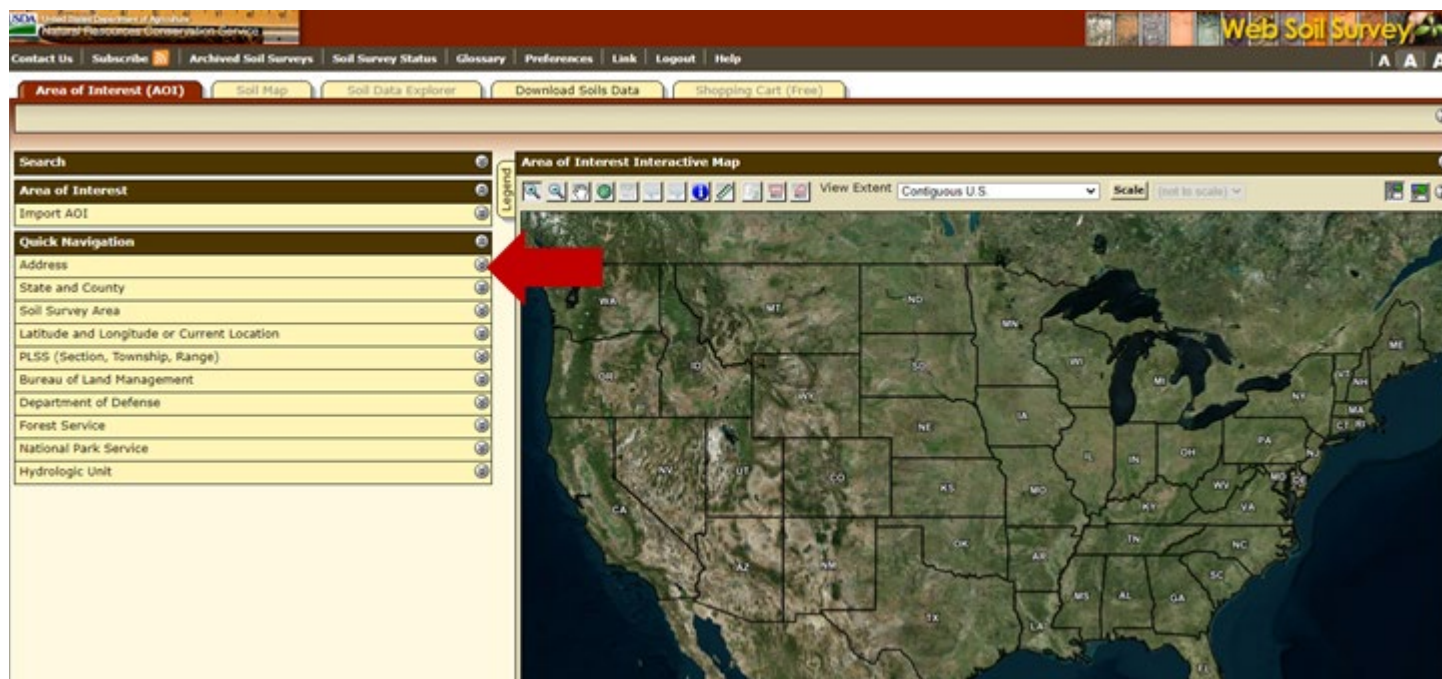
After locating the site, you can use the create AOI (Area of Interest) toggles above the map to select the entire drainage area for the site. These toggles will allow you to draw the drainage area on the map.



Once you have identified the drainage area with the AOI, click on the "Soil Map" tab. This will load all of the soil types within the drainage area both on the map and in a table on the left hand of the screen. The table will display the acres and percentage of the total area for each soil type.
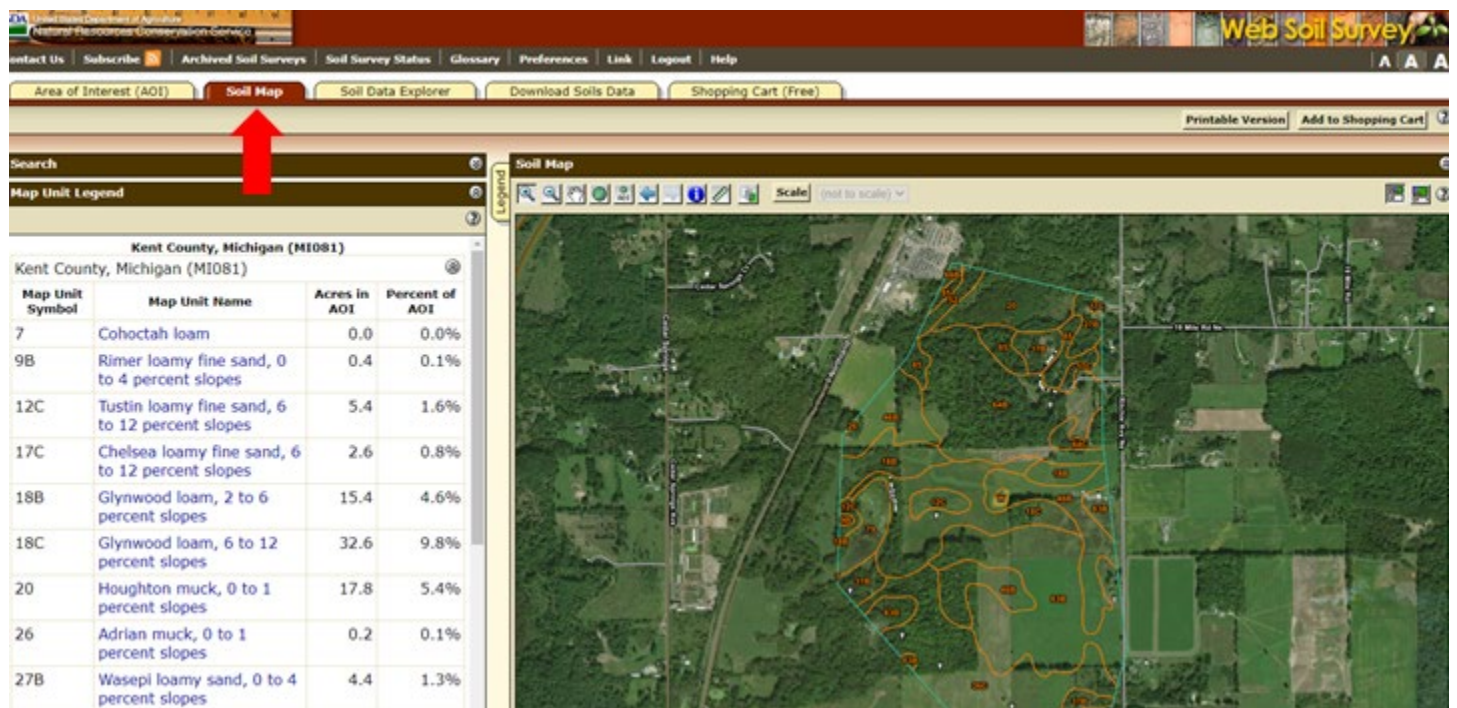
To determine to soil type (A,B,C, and D) referenced on the "Runoff Volume" tab of this workbook, click on the name of each soil in the table on the left hand of the screen. This will open a pop-up window that displays information about the selected soil.



Scroll down to the section labeled "Interpretive groups" and look for the "Hydrologic Soil Group". This will list the soil type. It is important to note that if two letters are listed for example A/D this means that the soils behaves like an A soil if there is an onsite drainage practice (for example an underdrain or tile drain) and behaves like a D soil when there is no active drainage practice.

**Description of Cohoctah**
  **Setting**
      *Landform:* Flood plains
      *Landform position (three-dimensional):* Talf
      *Down-slope shape:* Linear
      *Across-slope shape:* Linear
      *Parent material:* Loamy alluvium

  **Typical profile**
      *H1 - 0 to 10 inches:* loam
      *H2 - 10 to 31 inches:* sandy loam
      *H3 - 31 to 60 inches:* fine sandy loam

  **Properties and qualities**
      *Slope:* 0 to 2 percent
      *Depth to restrictive feature:* More than 80 inches
      *Drainage class:* Poorly drained
      *Runoff class:* Very low
      *Capacity of the most limiting layer to transmit water (Ksat):* High
          (1.98 to 5.95 in/hr)
      *Depth to water table:* About 0 to 12 inches
      *Frequency of flooding:* Frequent, None
      *Frequency of ponding:* None
      *Available water capacity:* High (about 9.5 inches)

  **Interpretive groups**
      *Land capability classification (irrigated):* None specified
      *Land capability classification (nonirrigated):* 5w
      *Hydrologic Soil Group:* A/D
      *Ecological site:* F098XA004MI - Wet Floodplains
      *Hydric soil rating:* Yes

It is important to note that on the "Runoff Volume" tab runoff is calculated based on a combination of land use and soil types. Therefore, the information collected on the Wed Soil Survey should be compared to land-use maps and linked to determine the amount of area to put under each category.

# 5.0 Example Scenario

**Setting**

A region has been experiencing flashy flows. And in order to address this issue a series of BMPs are being proposed. In order to determine how much runoff needs to be captured the NPS runoff calculator will be used. The first step to accomplish this is to collect information about the presettlement and post-development conditions of the site.

Drainage Area: The total drainage area is roughly 1.5 acres.

Design Storm: To address the flashy flows the 2-yr 24-hr storm event will be used. For this region this equates to 2.40 inches of rainfall.

Presettlement: Looking at the presettlement condition, the region was covered by a mix of forest and wetlands with a small pond. Soil types for the region were distributed between the land uses with the forests having B soils and the wetlands having D soils.

Post-Development: Looking at the post-development condition, while the pond has remained the wetland area has been replaced with lawn and much of the forest has been replaced by impervious areas. There has been no change in the types of soil present at the site.

**Maps and Site Data**

The maps below show a rough representation (not drawn to scale) of the presettlement and post-development conditions for the region and the Table below each map summarize land uses and soils for each map.
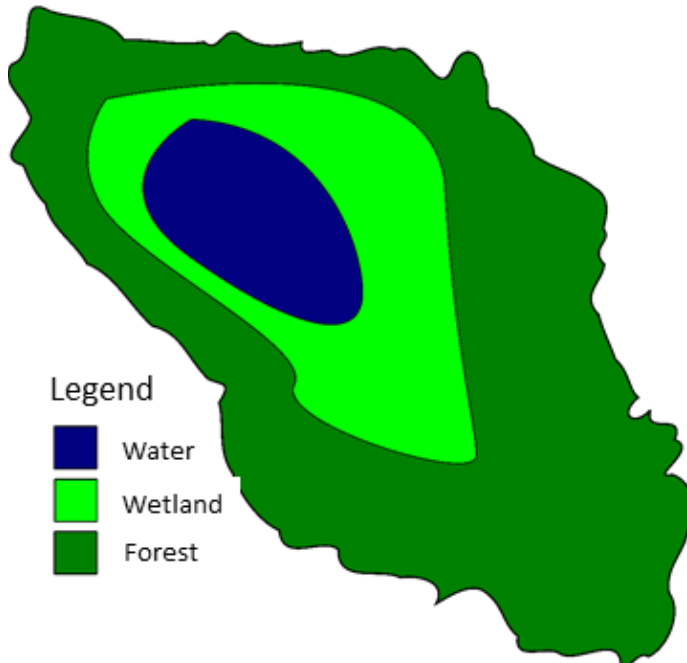


| Presettlement Land Uses and Soil Types | | |
|---|---|---|
| Land Use | Acres | Soil Type |
| Water | 0.25 | NA |
| Wetland | 0.25 | D |
| Forest | 1 | B |

| Post-development Land Uses and Soil Types | | |
|---|---|---|
| Land Use | Acres | Soil Type |
| Water | 0.25 | NA |
| Lawn | 0.25 | D |
| Forest | 0.25 | B |
| Impervious | 0.75 | NA |
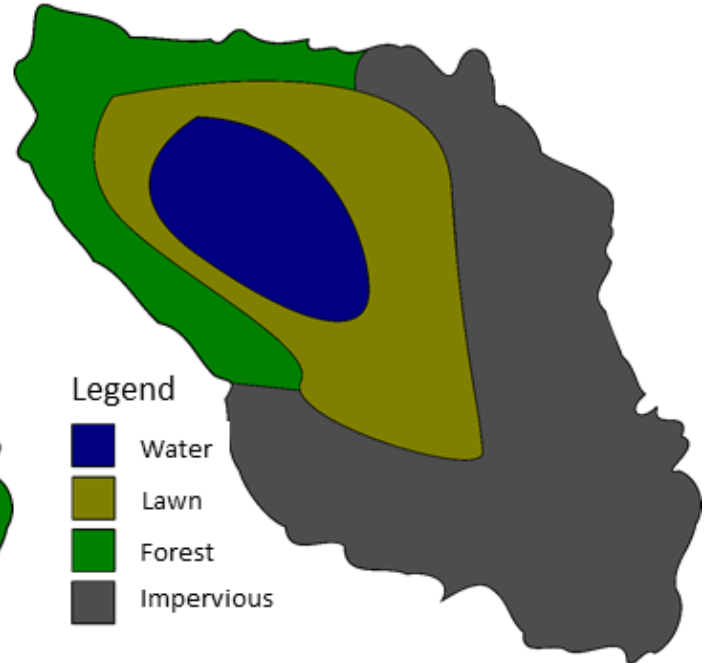
## NPS Storm Water Runoff Volume Calculator

Below is an example of how this information would be entered into the NPS Storm Water Runoff Volume Calculator.

### Calculations for Stormwater Runoff Volume Control

**SITE NAME:** Example Site

**EGLE**

**Total Drainage Area:** 1.5 acres

**Design Rainfall Event:** 2.4 in
(see Rainfall Tab for aid in using ATLAS 14 for determining local or site specific rainfall events)

**Presettlement Conditions**

| Land Cover Type | Soil Type | Area (sf) | Area (ac) | CN (from TR-55) | S | Q Runoff[1] (in) | Runoff Volume[2] (ft³) |
|---|---|---|---|---|---|---|---|
| | | | | | $\dfrac{1000}{CN} - 10$ | $\dfrac{(P - 0.2S)^2}{(P + 0.8S)}$ | $Q \times 1/12 \times A$ |
| Woods | A | 0 | | 30 | 23.3 | 0 | 0.0 |
| Grassland / Meadow | A | 0 | | 30 | 23.3 | 0 | 0.0 |
| Woods | B | 43560 | 1.00 | 55 | 8.2 | 0.0651885 | 236.6 |
| Grassland / Meadow | B | 0 | | 58 | 7.2 | 0.1105538 | 0.0 |
| Woods | C | 0 | | 70 | 4.3 | 0.4084034 | 0.0 |
| Grassland / Meadow | C | 0 | | 71 | 4.1 | 0.4421975 | 0.0 |
| Woods | D | 0 | | 77 | 3.0 | 0.6784179 | 0.0 |
| Grassland / Meadow | D | 0 | | 78 | 2.8 | 0.723845 | 0.0 |
| Impervious / Bedrock | N/A | 0 | | 98 | 0.2 | 2.1713506 | 0.0 |
| Wetland / Open Water | N/A | 21780 | 0.50 | 100 | 0.0 | 2.4 | 4,356.0 |
| Other: | | 0 | | | 0.0 | 2.4 | 0.0 |
| Other: | | 0 | | | 0.0 | 2.4 | 0.0 |
| **TOTAL:** | N/A | 65340 | 1.50 | N/A | N/A | N/A | 4,592.6 |

**Post-Development Conditions**

| Land Cover Type | Soil Type | Area (sf) | Area (ac) | CN* | S | Q Runoff[1] (in) | Runoff Volume[2] (ft³) |
|---|---|---|---|---|---|---|---|
| Impervious | N/A | 32670 | 0.75 | 98 | 0.2 | 2.1713506 | 5,911.5 |
| Wetland / Open Water | N/A | 10890 | 0.25 | 100 | 0.0 | 2.4 | 2,178.0 |
| Open Space / Lawn | A | 0 | | 39 | 15.6 | 0 | 0.0 |
| Open Space / Lawn | B | 0 | | 61 | 6.4 | 0.1673161 | 0.0 |
| Open Space / Lawn | C | 0 | | 74 | 3.5 | 0.5528541 | 0.0 |
| Open Space / Lawn | D | 10890 | 0.25 | 80 | 2.5 | 0.8204545 | 744.6 |
| Other: Woods | B | 10890 | 0.25 | 55 | 8.2 | 0.0651885 | 59.2 |
| Other: | | 0 | | | 0.0 | 2.4 | 0.0 |
| Other: | | 0 | | | 0.0 | 2.4 | 0.0 |
| Other: | | 0 | | | 0.0 | 2.4 | 0.0 |
| **TOTAL:** | N/A | 65340 | 1.50 | N/A | N/A | N/A | 8,893.2 |

**Runoff Volume Increase (ft³):** 4,301

Runoff Volume Increase = (Post-Dev. Runoff Volume) MINUS (Pre-Dev. Runoff Volume)

1. Runoff (in) = $Q = (P - Ia)2 / (P - Ia) + S$
   $Ia = 0.2S$ therefore;
   **Runoff (in)** = $Q = (P - 0.2S)^2 / (P + 0.8S)$

2. **Runoff Volume (ft³)** = $Q \times 1/12 \times$ Area

Where: P = 2-Year, 24-Hour Rainfall (in)
S = 1000/ CN - 10
CN = Curve Number
Q = Runoff (in)
Area = Area of specific land cover (ft²)

* Runoff Volume must be calculated separately for pervious and impervious areas (without using a weighted CN)

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